

Claims

- 1 ~~SUB 1~~ 1. A method for encoding a frame having a
2 noisy portion, said frame comprising a plurality of
3 macroblocks, said method comprising for each
4 macroblock of said plurality of macroblocks:
- 5 (i) determining a macroblock activity
6 level;
- 7 (ii) determining when said macroblock
8 activity level exceeds a predefined threshold,
9 wherein said macroblock activity level exceeding
10 said predefined threshold indicates that said
11 macroblock is associated with said noisy portion
12 of said frame; and
- 13 (iii) adjusting encoding of said
14 macroblock when said macroblock activity level
15 exceeds said predefined threshold to conserve
16 bits used in encoding said macroblock and
17 thereby save bits otherwise used to encode said
18 noisy portion of said frame.
- 1 2. The method of claim 1, wherein said frame
2 further comprises a normal portion, and wherein said
3 method comprises using said saved bits from said
4 noisy portion of said frame to encode macroblocks
5 associated with said normal portion of said frame.

1 3. The method of claim 1, wherein each
2 macroblock of said plurality of macroblocks comprises
3 multiple blocks, and wherein said determining (i)
4 comprises determining an activity level for each
5 block of said multiple blocks of said macroblock, and
6 deriving therefrom an activity level for said
7 macroblock.

1 4. The method of claim 3, wherein said
2 deriving comprises ordering activity levels of said
3 multiple blocks of said macroblock and comparing a
4 minimum activity level of said order with a next to
5 minimum activity level of said order to derive said
6 activity level for said macroblock.

1 5. The method of claim 4, wherein said
2 comparing further comprises comparing said minimum
3 activity level of said order with an average activity
4 level of said multiple blocks of said macroblock to
5 derive said activity level for said macroblock.

1 6. The method of claim 5, wherein said
2 comparing comprises determining whether said minimum
3 activity level is less than one-half said next to
4 minimum activity level and whether said minimum
5 activity level is less than one-half said average
6 activity level of said multiple blocks, and when both
7 are so, defining said activity level of said
8 macroblock as said next to minimum activity level of
9 said order, otherwise defining said activity level of
10 said macroblock as said minimum activity level of
11 said order.

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10. The method of claim 9, wherein said
determining of said adjusted quantization level
comprises calculating a quantization level (CAL QL)
for said macroblock and defining said adjusted
quantization level (ADJ QL) as:

ADJ QL=MIN((1 + 0.25 (TH2 - BR + 1))·CAL QL; MAX ALLOWED BY
STANDARD)

Where: BR is the target bitrate;
TH2 is a second predefined value; and
MAX QL ALLOWED BY STANDARD is a maximum
quantization level allowed by MPEG standard.

11. The method of claim 1, wherein said frame
comprises one frame of a sequence of frames, and said
method further comprises initially determining for
each frame of said sequence of frames whether said
frame includes said noisy portion.

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12. The method of claim 11, wherein said
determining whether said frame comprises said noisy
portion includes calculating a frame complexity value
and comparing said frame complexity value to a
predefined complexity threshold.

13. The method of claim 12, wherein said frame
comprises a plurality of pixels, and wherein each
pixel of said frame comprises a multi-bit value, and
wherein said frame complexity value comprises an
accumulated absolute difference value (PIX-DIFF)
derived from adjacent pixels of said plurality of
pixels of said frame.

14. The method of claim 13, wherein said PIX-DIFF is defined as:

$$\text{Max} \sum_{y=1,3,5,\dots} |L_y - L_{y+1}|$$

1 15. The method of claim 13, further comprising
2 setting a noisy picture flag to "0" when said frame
3 complexity value is less than said predefined
4 complexity threshold.

1 16. The method of claim 13, wherein said
2 determining whether said frame comprises said noisy
3 portion further includes comparing a target bitrate
4 for said frame to a predefined bitrate threshold and
5 when said target bitrate for said frame exceeds said
6 predefined bitrate threshold, said method further
7 comprises setting a noisy picture flag equal to "0",
8 and if said target bitrate is less than said
9 predefined bitrate threshold, then setting said noisy
10 picture flag to "1", wherein said "1" noisy picture
11 flag setting indicates said frame includes said noisy
12 portion.

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19. The method of claim 18, wherein said deriving of said PIX-DIFF comprises forming a string of pixels by concatenating said plurality of pixels of said frame and defining PIX-DIFF as:

$$\sum_{y=1,3,5...}^{\text{Max}} |L_y - L_{y+1}|$$

Where: L represents luminance value of a pixel, and y represents pixel position within the string of pixels.

20. The method of claim 18, wherein when said frame complexity value is less than said predefined complexity threshold, said method further comprises setting a noisy picture flag to "0" and performing normal encoding on said frame, and wherein when said frame complexity value is greater than said predefined complexity threshold, said method further comprises determining whether a target bitrate of said frame is less than a predefined bitrate threshold, wherein when said target bitrate of said frame exceeds said predefined bitrate threshold, said method comprises setting said noisy picture flag to "0", and when said target bitrate of said frame is less than said predefined bitrate threshold, said method comprises setting said noisy picture flag to "1", wherein said "1" noisy picture flag setting indicates that said frame includes said random noise portion.

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21. The method of claim 17, wherein said evaluating comprises for each macroblock determining a macroblock activity level and determining when said macroblock activity level exceeds a predefined activity threshold, wherein said macroblock activity level exceeding said predefined activity threshold indicates that said macroblock is within said random noise portion of said frame.

22. The method of claim 21, wherein said adjusting encoding comprises performing motion estimation on said macroblock and selectively adjusting macroblock coding type for said macroblock to bias said macroblock towards being coded predictive when said macroblock activity level exceeds said predefined activity threshold, said selectively adjusting being with reference to a predictive error value resulting from said performing motion estimation on said macroblock, and further comprising determining an adjusted quantization level for said macroblock for use in encoding said macroblock, said adjusted quantization level being determined to reduce bits used in encoding said macroblock.

1 23. The method of claim 17, wherein said frame
2 further includes a normal video portion, and said
3 reducing bits comprises conserving bits used in
4 encoding said at least some macroblocks within said
5 random noise portion for use within said normal video
6 portion of said frame.

1 ~~SUBA3~~ 24. A system for encoding a frame having a
2 noisy portion, said frame comprising a plurality of
3 macroblocks, said system comprising:

4 (i) means for determining a macroblock
5 activity level;

6 (ii) means for determining when said
7 macroblock activity level exceeds a predefined
8 threshold, wherein said macroblock activity
9 level exceeding said predefined threshold
10 indicates that said macroblock is associated
11 with said noisy portion of said frame; and

12 (iii) means for adjusting encoding of said
13 macroblock when said macroblock activity level
14 exceeds said predefined threshold to conserve
15 bits used in encoding said macroblock and
16 thereby save bits otherwise used to encode said
17 noisy portion of said frame.

1 25. The system of claim 24, wherein said frame
2 further comprises a normal portion, and wherein said
3 system comprises means for using said saved bits from
4 said noisy portion of said frame to encode
5 macroblocks associated with said normal portion of
6 said frame.

1 26. The system of claim 24, wherein each
2 macroblock of said plurality of macroblocks comprises
3 multiple blocks, and wherein said means for
4 determining (i) comprises means for determining an
5 activity level for each block of said multiple blocks
6 of said macroblock, and means for ordering activity
7 levels of said multiple blocks of said macroblock and
8 comparing a minimum activity level of said order with
9 a next to minimum activity level of said order to
10 derive an activity level for said macroblock.

1 27. The system of claim 26, wherein said means
2 for comparing comprises means for determining whether
3 said minimum activity level is less than one-half
4 said next to minimum activity level and whether said
5 minimum activity level is less than one-half an
6 average activity level of said multiple blocks, and
7 when both are true, for defining said activity level
8 of said macroblock as said next to minimum activity
9 level in said macroblock, otherwise for defining said
10 activity level of said macroblock as said minimum
11 activity level of said order.

1 28. The system of claim 24, wherein said means
2 for adjusting encoding (iii) comprises means for
3 performing motion estimation on said macroblock and
4 for selectively adjusting macroblock coding type for
5 said macroblock to bias said macroblock towards being
6 coded predictive when said macroblock activity level
7 exceeds said predefined threshold, said selectively
8 adjusting being with reference to a predictive error
9 value resulting from said performing of motion
10 estimation on said macroblock.

29. The system of claim 28, wherein said means for selectively adjusting comprises means for determining when said predictive error is greater than a second predefined threshold and when said predictive error is greater than one-half said macroblock activity level, and when both are so, said means for selectively adjusting comprises means for adjusting a macroblock coding type parameter to bias said macroblock towards being coded predictive.

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31. A system for encoding a frame of a sequence of frames, each frame having a plurality of macroblocks, said system comprising:

4 a pre-encode processing unit for
5 determining whether said frame includes a random
6 noise portion; and

7 a control and encode unit for evaluating
8 each macroblock of said plurality of macroblocks
9 in said frame when said frame includes said
10 random noise portion, said control and encode
11 unit including means for adjusting encoding of
12 at least some macroblocks within said random
13 noise portion of said frame to reduce bits used
14 in encoding said at least some macroblocks
15 within said random noise portion.

1 32. The system of claim 31, wherein each frame
2 of the sequence of frames comprises a plurality of
3 pixels, each pixel of each frame comprising a multi-
4 bit value, and wherein said pre-encode processing
5 unit comprises means for deriving a frame complexity
6 value and for comparing said frame complexity value
7 to a predefined complexity threshold, said means for
8 deriving of said frame complexity value including
9 means for deriving an accumulated absolute difference
10 (PIX-DIFF) from adjacent pixels of said plurality of
11 pixels of said frame.

12345678910111213141516171819202122232425262728293031323334353637383940414243444546474849505152535455565758596061626364656667686970717273747576777879808182838485868788899091929394959697989910010110210310410510610710810911011111211311411511611711811912012112212312412512612712812913013113213313413513613713813914014114214314414514614714814915015115215315415515615715815916016116216316416516616716816917017117217317417517617717817918018118218318418518618718818919019119219319419519619719819920020120220320420520620720820921021121221321421521621721821922022122222322422522622722822923023123223323423523623723823924024124224324424524624724824925025125225325425525625725825926026126226326426526626726826927027127227327427527627727827928028128228328428528628728828929029129229329429529629729829930030130230330430530630730830931031131231331431531631731831932032132232332432532632732832933033133233333433533633733833934034134234334434534634734834935035135235335435535635735835936036136236336436536636736836937037137237337437537637737837938038138238338438538638738838939039139239339439539639739839940040140240340440540640740840941041141241341441541641741841942042142242342442542642742842943043143243343443543643743843944044144244344444544644744844945045145245345445545645745845946046146246346446546646746846947047147247347447547647747847948048148248348448548648748848949049149249349449549649749849950050150250350450550650750850951051151251351451551651751851952052152252352452552652752852953053153253353453553653753853954054154254354454554654754854955055155255355455555655755855956056156256356456556656756856957057157257357457557657757857958058158258358458558658758858959059159259359459559659759859960060160260360460560660760860961061161261361461561661761861962062162262362462562662762862963063163263363463563663763863964064164264364464564664764864965065165265365465565665765865966066166266366466566666766866967067167267367467567667767867968068168268368468568668768868969069169269369469569669769869970070170270370470570670770870971071171271371471571671771871972072172272372472572672772872973073173273373473573673773873974074174274374474574674774874975075175275375475575675775875976076176276376476576676776876977077177277377477577677777877978078178278378478578678778878979079179279379479579679779879980080180280380480580680780880981081181281381481581681781881982082182282382482582682782882983083183283383483583683783883984084184284384484584684784884985085185285385485585685785885986086186286386486586686786886987087187287387487587687787887988088188288388488588688788888989089189289389489589689789889990090190290390490590690790890991091191291391491591691791891992092192292392492592692792892993093193293393493593693793893994094194294394494594694794894995095195295395495595695795895996096196296396496596696796896997097197297397497597697797897998098198298398498598698798898999099199299399499599699799899910001001100210031004100510061007100810091010101110121013101410151016101710181019102010211022102310241025102610271028102910301031103210331034103510361037103810391040104110421043104410451046104710481049105010511052105310541055105610571058105910601061106210631064106510661067106810691070107110721073107410751076107710781079108010811082108310841085108610871088108910901091109210931094109510961097109810991100110111021103110411051106110711081109111011111112111311141115111611171118111911201121112211231124112511261127112811291130113111321133113411351136113711381139114011411142114311441145114611471148114911501151115211531154115511561157115811591160116111621163116411651166116711681169117011711172117311741175117611771178117911801181118211831184118511861187118811891190119111921193119411951196119711981199120012011202120312041205120612071208120912101211121212131214121512161217121812191220122112221223122412251226122712281229123012311232123312341235123612371238123912401241124212431244124512461247124812491250125112521253125412551256125712581259126012611262126312641265126612671268126912701271127212731274127512761277127812791280128112821283128412851286128712881289129012911292129312941295129612971298129913

1 34. The system of claim 33, wherein said
2 control and encode unit further comprises means for
3 determining for each macroblock a macroblock activity
4 level and for determining when said macroblock
5 activity level exceeds a predefined activity
6 threshold, wherein said macroblock activity level
7 exceeding said predefined activity threshold
8 indicates that said macroblock is within said random
9 noise portion of said frame.

1 35. The system of claim 34, wherein said means
2 for adjusting encoding comprises means for performing
3 motion estimation on said macroblock and means for
4 selectively adjusting macroblock coding type for said
5 macroblock to bias said macroblock towards being
6 coded predictive when said macroblock activity level
7 exceeds said predefined activity threshold, said
8 means for selectively adjusting being with reference
9 to a predictive error value resulting from performing
10 motion estimation on said macroblock, and wherein
11 said control and encode unit further comprises means
12 for determining an adjusted quantization level for
13 said macroblock for use in encoding said macroblock,
14 said adjusted quantization level being determined to
15 reduce bits used in encoding said macroblock.

1 36. The system of claim 35, wherein said frame
2 further includes a normal video portion, and said
3 means for adjusting encoding comprises means for
4 conserving bits used in encoding said at least some
5 macroblocks within said random noise portion for use
6 in encoding macroblocks within said normal video
7 portion of said frame.

11-13 > 38. A computer program product comprising
2 computer usable medium having computer readable
3 program code means therein for use in encoding a
4 frame of a sequence of frames, each frame having a
5 plurality of macroblocks, said computer readable
6 program code means in said computer program product
7 comprising:

11 computer readable program code means for
12 causing a computer to affect evaluating each
13 macroblock of said plurality of macroblocks in
14 said frame and when said frame includes said
15 random noise portion, adjusting encoding of at
16 least some macroblocks within said random noise
17 portion of said frame, said adjusting comprising
18 reducing bits used in encoding said at least
19 some macroblocks within said random noise
20 portion.

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